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Application of Six Sigma Dmaic and Kaizen Methods In Efforts to Improve The Quality of T-Shirt Isles Banana Seven Products in Textile Industry

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a r t i c l e i n f o

a b s t r a c t

Application of Six Sigma Dmaic and Kaizen Methods In Efforts to Improve The Quality of T-Shirt Isles Banana Seven Products in Textile Industry. Textile Industry Company is a company engaged in manufacturing that produces textiles and garments. The Textile Industry Company in producing isles banana seven t-shirt clothing has a problem, namely the relatively large number of defects in production. The percentage of company disability in producing isles banana seven t-shirt clothing can reach 13%. see problems in the Textile Industry Company company that has a high percentage of product defects. Researchers will conduct quality control with the six sigma and kaizen DMAIC methods to reduce the number of disabilities and control disability in companies in producing isles banana seven t-shirt products. Critical To Quality (CTQ) for the most defects in the product of banana seven t-shirt is 4, namely jumping stitches (25.15%), broken stitching (23.96%), gross (22.50%), and perforated (14) , 63%). The DPMO for the isles banana seven t-shirt is 24336 units with a sigma capability of 3.47-sigma. The results of the analysis in kaizen prioritize the need for periodic checks of all facilities used.

K e y w o r d s :
Six Sigma; DMAIC; Kaizen; Quality

INTRODUCTION

The development of technology and science in the industry is currently developing very rapidly. This development encouraged the establishment of new companies, especially those engaged in manufacturing. The urge to build a new company is because of the increasing market needs and demands. This can be used as a guideline that quality control is part of the production process which is very influential in improving product quality, so that the fulfillment of services to consumers can be achieved. Quality itself is the overall characteristics of a product or service that is able to give satisfaction to customers or consumers.

Quality control is an activity to know, maintain and control the quality of the products the company makes. The more the company pays attention to quality control, it will make the products produced by the company will be good and certainly profitable for the company. Companies in improving the quality of their products, companies must first realize the company's ability to what companies are able to produce these products.

Textile Industry Company is a company engaged in manufacturing that produces textiles and garments. The products produced are underwear and apparel. Competition between companies in the textile and garment fields requires companies to meet the needs of consumers at the right time and in the right amount. One of the things that must be done is to control quality. The isles banana seven t-shirt product was chosen because it was in a very thorough process and product supervision and was produced by the Textile Industry Company to meet export needs. The Textile Industry Company in producing isles banana seven t-shirt clothing has a problem, namely the relatively large number of defects in production. The percentage of company disability in producing isles banana seven t-shirt clothing can reach 13%.

By looking at the problems in the Textile Industry Company companies that have a high percentage of product defects. Researchers will carry out quality control with the six sigma and kaizen DMAIC methods to reduce the number of disabilities and control disability in companies in producing isles banana seven t-shirt products.

LITERATURE REVIEW

DMAIC stages (Define, Measure, Analyze, Improve & Control)

Define

This stage is the initial stage in the DMAIC phase. The definition of the DMAIC approach is to identify the stages to determine the main problem, research objectives, and scope of the process (Gasperz, 2000)

1. Identify important problems in processes.
2. Choosing a project to overcome one or more problems and determine the parameters of the project.
3. Define several vital factors to be measured, analyzed, corrected, and controlled.

Measure

This stage is the second stage, there are things that must be done namely (Pyzdek, 2002):

1. Measure current performance

2. Conduct and develop plans at the process or output level

Analyze

Analyze is the third stage in the six sigma quality improvement program, by identifying the root causes of disability or failure in the process (Gasperz, 2006)

Improve

This is a step to establish a plan of action to improve the quality of this step can use kaizen (Pyzdek, 2002).
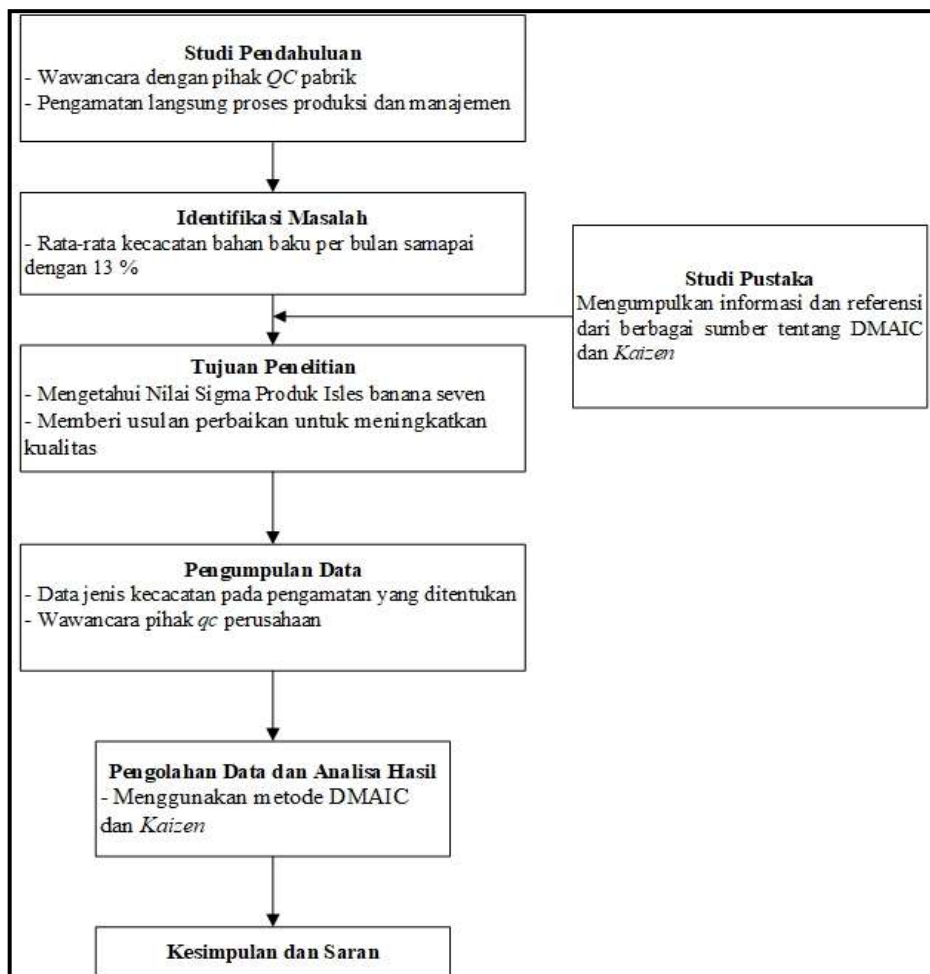
Control

It is the final stage at this stage that quality improvement is used as a work guideline to prevent old problems from returning (Pyzdek, 2002).

Kaizen

Kaizen is a Japanese term for continuous incremental improvement. This Kaizen only works well if its human resources are right because for the improvement of quality and productivity is an important measurement dimension (Singgih, 2008)

.METHODS

The research methodology is the step that will be carried out in conducting this research. The research methodology is useful so that research is more directed and structured. The following are the steps carried out in conducting this research

Studi Pendahuluan
- Wawancara dengan pihak *QC* pabrik
- Pengamatan langsung proses produksi dan manajemen

Identifikasi Masalah
- Rata-rata kecacatan bahan baku per bulan samapai dengan 13 %

Studi Pustaka
Mengumpulkan informasi dan referensi dari berbagai sumber tentang DMAIC dan *Kaizen*

Tujuan Penelitian
- Mengetahui Nilai Sigma Produk Isles banana seven
- Memberi usulan perbaikan untuk meningkatkan kualitas

Pengumpulan Data
- Data jenis kecacatan pada pengamatan yang ditentukan
- Wawancara pihak *qc* perusahaan

Pengolahan Data dan Analisa Hasil
- Menggunakan metode DMAIC dan *Kaizen*

Kesimpulan dan Saran

RESULT AND DISCUSSION

Define Stage

1. Problems

The Textile Industry Company has set specifications for determining the quality of the isles banana seven t-shirt products. This quality determination will find out which products are not in accordance with product specifications or product defects or reject. Defects in the Banana Seven T-shirt product include BS material, dirty, perforated, broken stitching, and jump stitch.

2. Purpose

The aim is to maintain the quality of the isles banana seven t-shirt product so that product records can be reduced and quality is determined to meet customer satisfaction.

Measure Stage

The measure phase is carried out determining Critical to Quality (CTQ), calculating the control chart and calculating the value of DPMO (Defect per Million Oppurtunities) and sigma level.

1. Determine Critical to Quality (CTQ)

There are five types of defects in the product attribute of t-shirt isles banana seven, namely BS material, dirty, perforated, broken stitching, and jump stitch.

Table 1 Type of Product Defect

Observation	Amount	Type of product defect					Number of defect types (Unit)
		Fabric BS	Dirty	Perforated	Broken stitches	Jump stitches	
1	892	5	15	1	12	6	39
2	774	1	2	0	18	37	58
3	316	3	16	12	8	3	42
4	725	13	38	3	22	33	109
5	754	15	12	21	10	15	73
6	343	5	6	0	13	9	33
7	285	1	14	0	20	15	50
8	255	8	11	23	18	0	60
9	169	6	5	6	8	3	28
10	241	4	22	2	3	4	35
11	389	3	7	11	12	9	42
12	440	5	19	0	16	22	62
13	880	9	19	16	21	27	92
14	824	7	26	18	18	35	104
15	766	5	20	12	22	36	95
16	266	7	4	22	12	1	46
17	260	12	2	13	3	1	31
18	200	13	1	2	2	2	20
19	282	6	3	4	15	1	29
20	713	12	1	3	22	32	70
21	681	12	23	3	2	21	61
22	249	1	23	12	1	1	38
23	327	6	3	14	20	1	44
24	526	13	3	3	32	3	54
25	200	3	23	0	4	3	33
26	207	7	2	0	14	0	23
27	221	5	2	3	1	22	33
28	210	8	3	3	1	21	36
29	544	6	13	12	8	13	52
30	164	7	2	2	4	4	19
	12923	208	340	221	362	380	1511

Table 2 Presentation Type of Defect

Type of Defect	Defect Frequency (Unit)	Cumulative Defect (Unit)	Defect Presentation (%)	Defect Cumulative (%)
Jahitan Loncat	380	380	25,15	25,15
Jahitan Putus	362	742	23,96	49,11
Kotor	340	1082	22,50	71,61
Bolong	221	1303	14,63	86,23
BS Bahan	208	1511	13,77	100
	1511		100	

2. Map of control P

Attribute control map is used to monitor the results of the production process of a product in an attribute (visual)

Table 3 Proportions of Full Control Map P

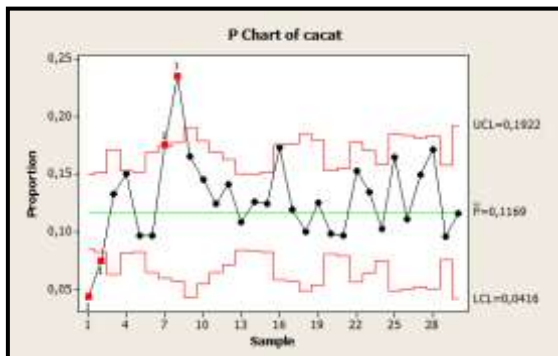| Observation	Number of Production (Units)	Number of types of defect	Proportion
1	892	39	0,04
2	774	58	0,07
3	316	42	0,13
4	725	109	0,15
5	754	73	0,09
6	343	33	0,09
7	285	50	0,17
8	255	60	0,23
9	169	28	0,16
10	241	35	0,14
11	339	42	0,12
12	440	62	0,14
13	850	92	0,1
14	824	104	0,12
15	766	95	0,12
16	266	46	0,17
17	260	31	0,11
18	200	20	0,1
19	232	29	0,12
20	713	70	0,09
21	631	61	0,09
22	249	38	0,15
23	327	44	0,13
24	526	54	0,1
25	200	33	0,16
26	207	23	0,11
27	221	33	0,14
28	210	36	0,17
29	544	52	0,09
30	164	19	0,11

Figure 1

Based on the P control chart graph in Figure 1 above, it can be seen that all data contained graphs coming out of the upper control limit (UCL) and the lower control limit (LCL). These results indicate the need for data revision. Next is the revised control chart.

Table 4 Proportions of the Revised Control P Map

Observation	Number of Production (Units)	Number of types of defect	Proportion
3	316	42	0,13
4	725	109	0,15
5	754	73	0,09
6	343	33	0,09
9	169	28	0,16
10	241	35	0,14
11	339	42	0,12
12	440	62	0,14
13	850	92	0,1
14	824	104	0,12
15	766	95	0,12
16	266	46	0,17
17	260	31	0,11
18	200	20	0,1
19	232	29	0,12
20	713	70	0,09
21	631	61	0,09
22	249	38	0,15
23	327	44	0,13
24	526	54	0,1
25	200	33	0,16
26	207	23	0,11
27	221	33	0,14
28	210	36	0,17
29	544	52	0,09
30	164	19	0,11

Figure 2 P Revised Control Map

Based on the P control chart in Figure 2 above, it can be seen that all data is within the control limit (incontrol) because all data is between the upper control limit (UCL) and the lower control limit (LCL). These results indicate that the process is running stably. Therefore, there is no need for data revisions.

3. Determine the DPMO

Determine the DPMO to find out how much the product is produced according to the specifications the company uses. DPMO (Defect Per Million Opportunities) value of the number of defects in the product per one million opportunities, while the level of sigma is the company's achievement of the quality produced by a product. Here are the DPMO of the isles banana seven t-shirt:

・ DPU

= Defect: Unit = 1304: 10717

= 0.121

・ TOP

= Unit x OP = 10717 x 5

= 53585

・ DPO

= Defect: TOP = 1304: 53585

= 0.024335

・ DPMO

= DPO x 106 = 0.024335 x 106

= 24335,16842

・ Six Sigma level

= NORMSINV ((1,000,000-24335,16842) / 1,000,000) +1.5

= 3.47

Based on the above DPMO calculations for the production of isles banana seven t-shirt products produce 24336 defective products from one million opportunities with a sigmatic value of 3.47. Therefore, improvements must be made.

Analyze Stage

This stage uses a fishbone diagram for disabilities that dominates by 80%, namely jumping, broken, dirty and perforated seams which determine the priority of the type of defect that is handled based on pareto 80; 20 rules. The four types of defects will be prioritized to analyze the root cause of the problem with a fishbone diagram.

a. Fishbone diagram (fishbone diagram) jump stitch
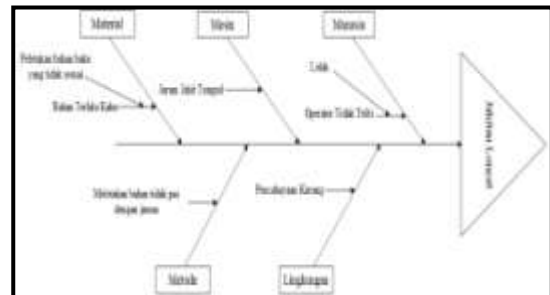
b. Fishbone diagram (broken fishbone diagram).
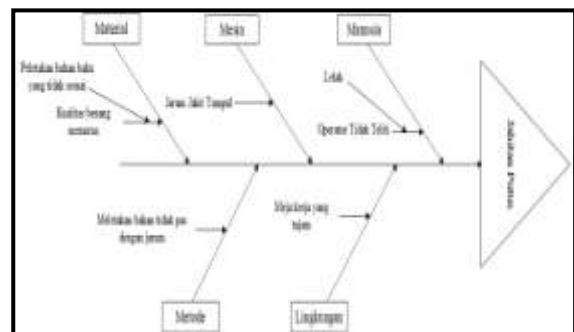
c. Dirty fishbone diagram.
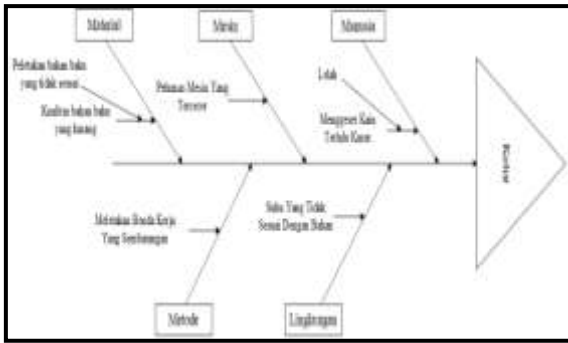
d. Fishbone diagram (hollow fishbone).
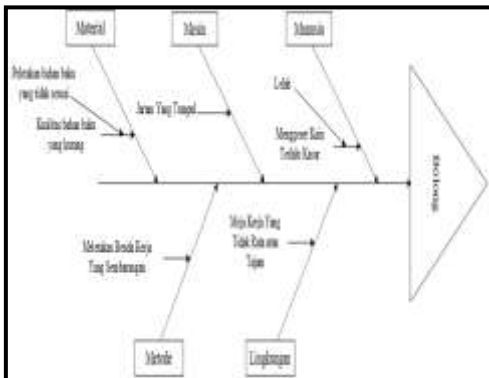
Improve Phase

Table 5 Analysis of Skip Stitch Problems
with the Five-M Checklist

No	Factor	Problem	Problem Solution
1	Human	Careless operator	Personal approach and training for operators
2	Machine	Blunt needle	Conduct periodic checks and replace blunt needles
3	Material	Raw material is too rigid	Put raw materials in accordance with standard temperatures on fabric raw materials according to

			the type of material
4	Method	Placing raw materials that do not fit into the raw materials	Conduct directives so that accuracy at work increases
5	Environment	Poor Lighting	Provides additional lighting so that the operator works comfortably and thoroughly

Table 6 Analysis of Broken Stitch
Problems with the Five-M Checklist

No	Factor	Problem	Problem Solution
1	Human	Careless operator	Personal approach and training for operators
2	Machine	Blunt needle	Conduct periodic checks and replace blunt needles
3	Material	The quality of the ingredients is decreasing	Carry out a FIFO system for taking threads in warehouses so that the yarn is of the highest quality
4	Method	Placing raw materials that do not fit into the raw materials	Conduct directives so that accuracy at work increases
5	Environ	Sharp	Check and

ment	work desk	repair the work table so that the wood when sewing is not sharp

Table 7 Analysis of Gross Problems with the Five-M Checklist

No	Factor	Problem	Problem Solution
1	Human	Shift the fabric too rough	Give direction to the operator to work more carefully
2	Machine	Spilled engine oil	Conduct periodic checks and clean the work area before working
3	Material	Poor quality of raw materials	Laying the raw materials according to the shelves provided and cleaning the storage shelves regularly
4	Method	Placing the workpiece carelessly	Conduct directives so that half-finished workpieces are placed in the space provided
5	Environment	The temperature does not match the material	Setting the temperature in the warehouse in accordance with the specifications of the type of fabric raw materials

Table 8 Analysis of Bolong Problems with the Five-M Checklist

No	Factor	Problem	Problem Solution
1	Human	Shift the fabric too rough	Give direction to the operator to work more carefully
2	Machine	Blunt needle	Conduct periodic checks and replace blunt needles
3	Material	Poor quality of raw materials	Laying of raw materials in accordance with the shelves provided and cleaning storage shelves regularly
4	Method	Placing the workpiece carelessly	Conduct directives so that semi-finished workpieces are placed in the space provided
5	Environment	Uneven and sharp work table	Check and repair the work table so that the wood when sewing is not sharp

The next step after using the Five-M Checklist is to use a five step plan with the application of the 5-S to the company as an improvement. Following is the application of 5-S to the company:

1. Seiri (Sorting)

Seiri has the meaning of sorting, which is grouping goods according to their type and function. The situation at the company is that all stations are neatly organized but the material to be processed is not neat or messy.

As a result:

· Time to find the material you want to process a long time

· The quality of the material that you want to use decreases

· Workers find it difficult to find the material they want to use

Implementation:

· Arranging the material you want to use according to the rack used

· Separating raw materials that are not in accordance with their functions or interests

2. Seiton

Seiton has the meaning of structuring that is putting the items in accordance with their appearance. The situation at the company is the arrangement of work tools that are far away and there is no place to arrange work tools.

As a result:

· Time to look for old work tools

· Preparation to do old work

· The work tool may be tucked or lost

Implementation:

· Preparing a place or rack to put work tools

· Labeling the work tools that are arranged

· Conduct periodic checks on the preparation of work tools

3. Seiso (cleanliness)

Seiso has the meaning of sustainability, which is to clean the work environment or facilities from dirt. The situation at the company is that the fabric of the remaining process is still scattered on the floor.

As a result:

· Harm workers if they are stepped on

· Reducing productivity

Implementation:

· Setting up a place for waste remaining in the process

· Familiarize yourself with cleaning after the process is complete

4. Seiketsu (Maintenance)

Seiketsu has the meaning of maintenance which is maintaining all factory or company facilities. Seiketsu has standardized maintenance of the facilities. Following is the implementation for maintenance.

Implementation:

· Periodically inspect all facilities used

· Determination of reasonable and unnatural situations

· Prepare a plan if a problem occurs

· Supervision or monitor the work of workers

5. Shitsuke (habituation)

Shitsuke has the meaning of habituation, namely habituation of all workers to meet the rules and discipline. Shitsuke must have a goal to shape worker awareness. Following is the implementation for habituation.

Implementation:

· Provide briefing time before work

· Conducting activities together

· Getting used to prioritize K3

・Assign individual responsibilities

CONCLUSION AND IMPLICATION

From the results of the discussion above it can be concluded as follows:

Critical To Quality (CTQ) for five isles banana seven t-shirt products namely jumping stitches (25.15%), broken stitches (23.96%), gross (22.50%), holes (14.63) %) and BS material (13.77%) with the number of defects in one month as many as 1511.

The DPMO value for the isles banana seven t-shirt is 24336 units with a sigma capability of 3.47-sigma, which means that in one million occasions there are 24336 units of products that are not in accordance with customer specifications and desires.

Factors causing defective products include inaccurate operators, blunt needles, raw materials that are not according to specifications, poor lighting and the placement of messy or inappropriate workpieces.

Proposed quality control and improvement based on kaizen with the application of 5-S, namely, the arrangement of materials in accordance with the shelves, arranging the work tools used, cleaning the work station after the process, checking facilities regularly and assigning responsibilities individually.

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